



[Claims]

[Claim 1]

A porous carbonaceous material product formed from any one of various types of bran, being characterized in that a product having a predetermined form is prepared by the steps of:

adding a thermosetting resin and an appropriate amount of an aqueous solution containing a glue or water to any one of various types of bran such as rice bran and wheat bran;

kneading the resultant bran mixture;

granulating the thus-kneaded bran mixture;

filling the resultant grains in a desired molding die;

forming the thus-filled grains; and

fire-carbonizing the resultant formed product in an inert gas atmosphere or in vacuum.

[Claim 2]

A porous carbonaceous material product formed from any one of various types of bran, being characterized in that a product having a predetermined form is prepared by the steps of:

adding a thermosetting resin and an appropriate amount of an aqueous solution containing a glue or water to any one of various types of bran such as rice bran and wheat bran;

kneading the resultant bran mixture;

removing a volatile matter by heating the thus-kneaded bran mixture at from about 60°C to about 80°C

granulating the bran mixture thus removed of the volatile matter;

sieving the resultant grains to obtain those having a predetermined grain size or less;

filling the resultant grains in a desired molding die;

forming the thus-filled grains while repeating pressurizing and degassing;

5 removing the resultant formed product from the molding die; and

fire-carbonizing the resultant formed product in an inert gas atmosphere or in vacuum.

[Claim 3]

10 A hard porous carbonaceous material product formed from any one of various types of bran, being characterized in that a product having a predetermined form and having an average hardness of 100 or more in terms of Vickers hardness is prepared by the steps of:

15 adding a thermosetting resin and an appropriate amount of an aqueous solution containing a glue or water to any one of various types of bran such as rice bran and wheat bran;

kneading the resultant bran mixture;

granulating the kneaded mixture;

sieving the resultant grains to obtain those having a predetermined grain size or less;

20 filling the resultant grains in a desired molding die;

forming the thus-filled grains; and

25 fire-carbonizing the resultant formed product in an inert gas atmosphere or in vacuum at around 700°C or more, and, further, the thus-prepared product having the predetermined form is, optionally, either subjected to a hydrolysis purification treatment in an acidic aqueous solution or not subjected to the treatment, to thereby

prepare a hard porous carbonaceous material product.

[Claim 4]

A hard porous carbonaceous material product formed from any one of various types of bran, being characterized in that a product having a predetermined form and having an average hardness of 100 or more in terms of Vickers hardness is prepared by the steps of:

adding a thermosetting resin and an appropriate amount of an aqueous solution containing a glue or water to any one of various types of bran such as rice bran and wheat bran;

kneading the resultant bran mixture;

removing a volatile matter by heating the thus-kneaded bran mixture at from about 60°C to about 80°C

granulating the bran mixture thus removed of the volatile matter;

sieving the resultant grains to obtain those having a predetermined grain size

or less;

filling the resultant grains in a desired molding die;

forming the thus-filled grains while repeating pressurizing and degassing;

removing the resultant formed product from the molding die; and

fire-carbonizing the resultant formed product in an inert gas atmosphere or in vacuum at around 700°C or more, and, further, the thus-prepared product having the predetermined form is, optionally, either subjected to a hydrolysis purification treatment in an acidic aqueous solution or not subjected to the treatment, to thereby prepare a hard porous carbonaceous material product.

[Brief Description of the Drawings]

A porous carbonaceous material product and a hard porous carbonaceous

material product representing the preset device are shown.

[FIG 1] It is an electron micrograph (magnifying power: 100) showing a cross-sectional structure of a hard porous carbonaceous material product according to the present device obtained by using defatted bran as a raw material.

5 [FIG 2] It is a graph showing Vickers hardness against each firing temperature of the same hard porous carbonaceous material product as in FIG. 1.

[FIG 3] It is a graph showing a friction coefficient value against each firing temperature of the hard porous carbonaceous material product prepared in the same manner as in the embodiment in FIG. 1.

10 [FIG 4] It is an electron micrograph (magnifying power: 100) showing a cross-sectional structure of a hard porous carbonaceous material product according to the present device obtained by using wheat bran as a raw material.

[FIG 5] It is an electron micrograph (magnifying power: 100) showing a cross-sectional structure of a hard porous carbon material product according to the present device obtained by using a gluten feed as a raw material.

[FIG 6] It is an electron micrograph (magnifying power: 100) showing a cross-sectional structure of a hard porous carbonaceous material product according to the present device obtained by using wood as a raw material.

20 FIG. 1

Photograph substituted for drawing

FIG. 3

Firing temperature and friction coefficient of defatted bran

FIG. 2

25 Firing temperature and Vickers hardness of defatted bran

FIG. 4

Photograph substituted for drawing

FIG. 5

Photograph substituted for drawing

5 FIG. 6

Photograph substituted for drawing

[Written Amendment]

[Filing Date] May 27, 1999

[Amendment 2]

5 [Type of the Document to be Amended] Description

[Item to be Amended] Claims

[Method of Amendment] Alteration

[Content of the Amendment]

[Claims]

10 [Claim 1]

A porous carbonaceous material product formed from any one of various types of bran, being characterized in that the product is formed such that:

a kneaded product comprising any one of various types of bran such as rice bran and wheat bran, a thermosetting resin and an appropriate amount of aqueous
15 solution containing a glue or water is granulated to grains which are, after adjusted of grain sizes thereof to be a predetermined one or less, formed into a formed product having a desired shape in a molding die having a desired shape; and

the thus-formed formed product is fire-carbonized at a temperature of about 700°C or more in an inert gas atmosphere or in vacuum to prepare a fired product
20 imparted with a desired shape and having an average hardness of 100 or more in terms of Vickers hardness,

wherein, in a cross-sectional compositional structure thereof, a majority of void portions are surrounded with carbon portions each having a relatively thick and dense structure and

25 these carbon portions each having the dense structure are made to be a hard

porous carbonaceous material product having a steric structure in which such carbon portions are irregularly bent to be in a mutually continuous or laminate state or a cross-sectional compositional structure close to the steric structure.

[Claim 2]

5 A porous carbonaceous material product formed from any one of various types of bran, being characterized in that the product is formed such that:

a kneaded product comprising any one of various types of bran such as rice bran and wheat bran, a thermosetting resin and an appropriate amount of aqueous solution containing a glue or water is granulated to grains which are, after adjusted of
10 grain sizes thereof to be a predetermined one or less, formed into a formed product having a desired shape in a molding die having a desired shape; and

the thus-formed formed product is fire-carbonized at a temperature of about 700°C or more in an inert gas atmosphere or in vacuum to prepare a fired product imparted with a desired shape and having an average hardness of 100 or more in terms
15 of Vickers hardness,

wherein, in a cross-sectional compositional structure thereof, void portions each having a relatively flat shape such that width is about 10 to 20 μm and length is about 100 μm and also having a clear-cut contour are present in the number of from 30 to 50 per mm^2 in a scattered manner and,

20 although some of carbon portions each containing an infinite number of pores each having a size of about several μm as a sponge-like structure are contained among these void portions, a majority of the void portions are surrounded with carbon portions each having a relatively thick and dense structure and these carbon portions each having the dense structure are made to be a hard porous carbonaceous material
25 product having a steric structure in which the carbon portions are irregularly bent to be

in a mutually continuous or laminate state or a cross-sectional compositional structure close to the steric structure.

[Claim 3]

5 A porous carbonaceous material product formed from any one of various types of bran according to Claim 1 or 2, wherein defatted bran is adopted as one of various types of bran.

[Claim 4]

10 A porous carbonaceous material product porous carbonaceous material product formed from any one of various types of bran according to Claim 1 or 2, wherein wheat bran or a gluten feed is adopted as one of various types of bran.